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Breitenstein, Alexander ; Steffel, Jan

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Leadless pacemaker tools used beyond device implantation



Alexander Breitenstein, MD, Jan Steffel, MD, FHRS

From the Electrophysiology, Department of Cardiology, University Hospital Zurich, Zurich, Switzerland.

Introduction

Infection of transvenous cardiac implantable electronic devices (CIEDs) are a serious complication with high morbidity and mortality.¹ Even though complete device and lead extraction is mandatory and recommended with a class I indication in current guidelines,² the decision of the type of intervention in case of large vegetations (eg, transvenous vs open surgical lead extraction) remains challenging. While a vegetation size >20 mm is a cut-off parameter to consider open surgical extraction according to the recent ESC/EACTS guidelines² (class IIb), smaller vegetations may be treated by transvenous lead extraction. However, in this context, it remains unclear why despite successful transvenous lead extraction and antibiotic treatment, the 1-year mortality remains high at 30% according to the European ELECTRA registry.¹ A closer look into the cause of death in this population reveals that nearly 50% of these patients die owing to ongoing sepsis. Since pulmonary embolization of vegetations during lead extraction may be the reason for this observation, various interventional techniques to reduce the size of vegetations have been evaluated, including the use of basket catheters for “vegetomy”³ or systemic thrombolysis.⁴ A transcatheter aspiration system based on an extracorporeal circuit in a venovenous configuration (AngioVac; Angiodynamics, Latham, NY) using a specialized filter has recently been introduced and is successfully used in an increasing number of patients.⁵ However, this

KEY TEACHING POINTS

- Conventional lead extraction using powered or non-powered sheaths harbors the risk of embolization of larger vegetation into the pulmonary vascular bed.
- To avoid this potential complication, either the patient needs to undergo open surgical lead extraction or the transvenous approach should to be adjusted accordingly using different tools.
- We herein describe the use of a large femoral sheath, commonly used for leadless pacemaker implantation, to successfully facilitate lead and vegetation extraction.

system has limitations such as need for therapeutic anticoagulation during the procedure and high healthcare costs. We herein describe the case of a patient suffering from CIED-related infection treated interventionally using a new concept.

Case report

A 55-year-old man with a dual-chamber pacemaker implanted 6 months ago was referred to our center owing to *Staphylococcus aureus* bacteremia. Transthoracic echocardiography confirmed the presence of a mobile, 10 × 12 mm mass attached to the ventricular lead located within the right atrium. A preinterventional venogram demonstrated occluded left subclavian and axillary veins. Because of this finding as well as the size of the vegetation, increased risk of pulmonary embolization of the vegetation during lead explantation was present, and we decided to change the conventional explantation approach. Via a right femoral venous access, a 27F sheath normally used for leadless pacemaker implantation (Micra TPS introducer sheath; Medtronic, Minneapolis, MN) was advanced to the low right atrium (Figure 1). The atrial lead could be explanted with simple traction from the infraclavicular pocket. Similarly, the ventricular lead was detached from the right ventricle and pulled back so that the distal end was free-floating within the right

KEYWORDS Device infection; Femoral approach; Large sheath; Lead extraction; Snare technique

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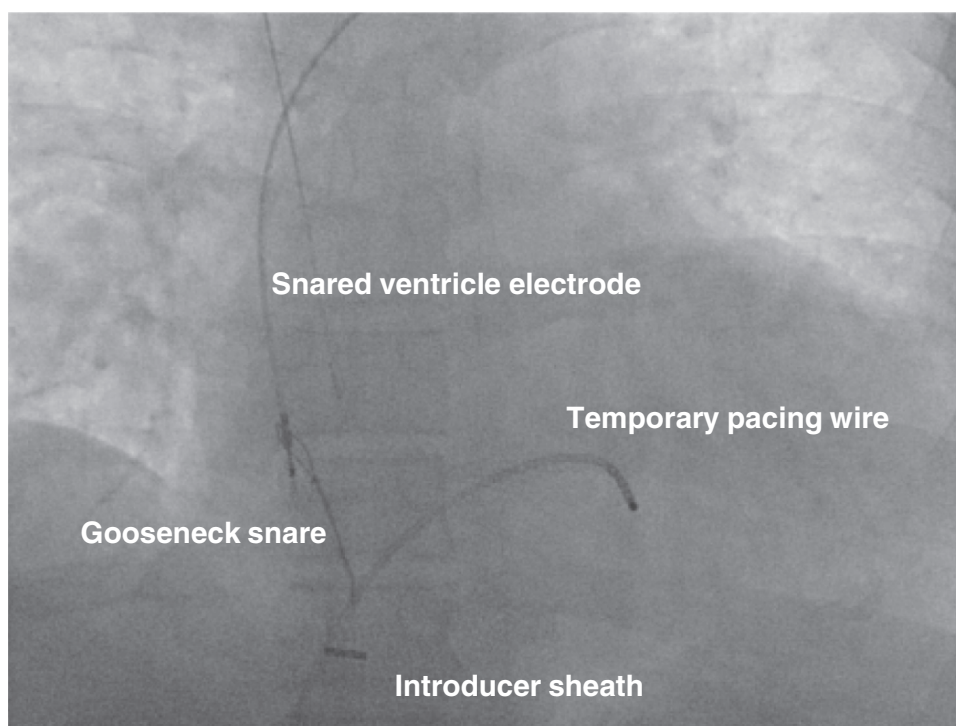


Figure 1 Snaring of the permanent pacemaker lead using a gooseneck snare introduced through the femoral introducer sheath.



Figure 2 The lead is being explanted with simple traction via the femoral introducer sheath.

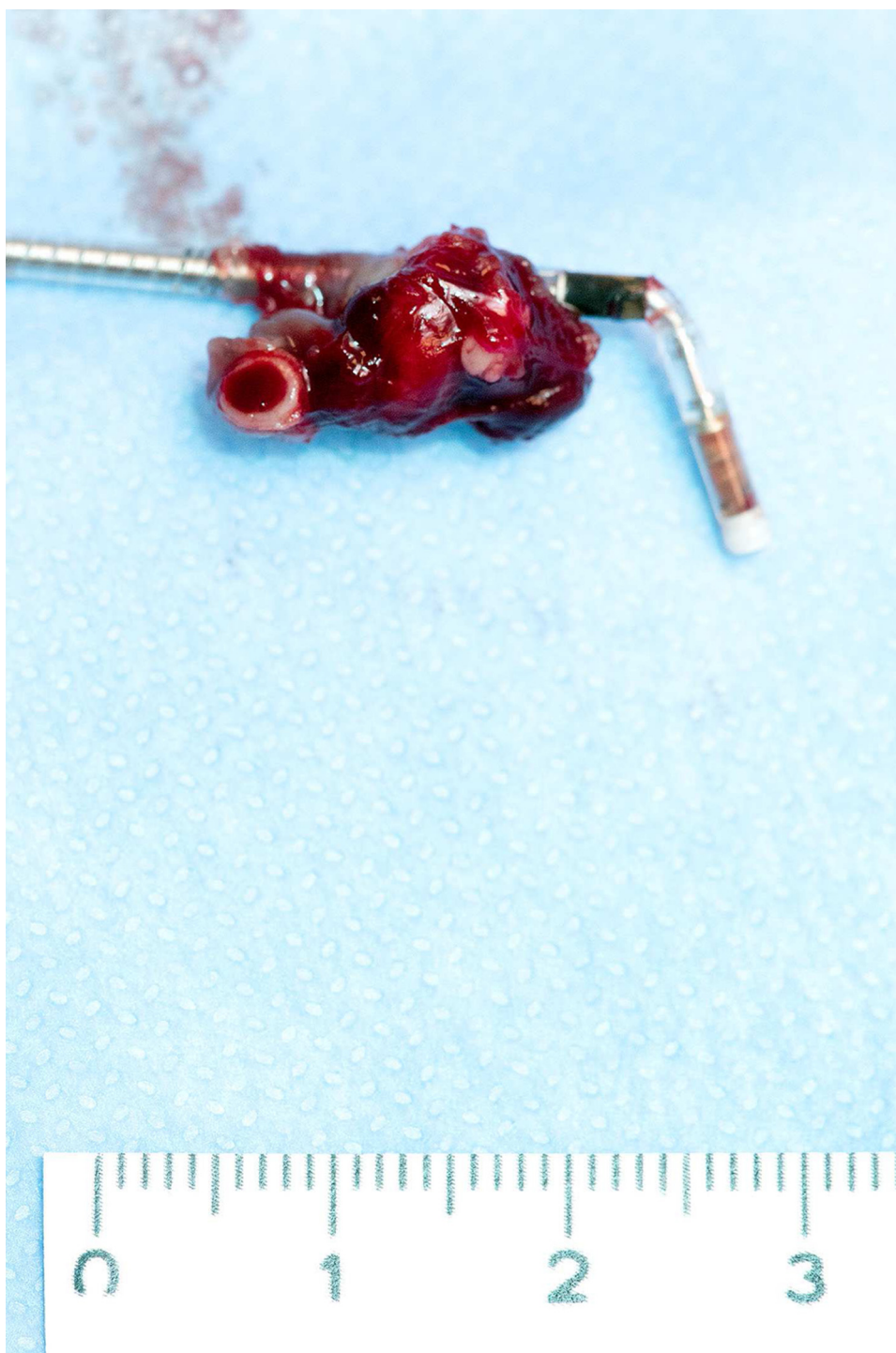


Figure 3 Explanted lead including the attached bacterial vegetation.

atrium. Through the 27F sheath, a 20 mm gooseneck snare was introduced and the distal end of the lead snared (Figure 1). The lead was cut at the proximal part within the infraclavicular pocket and pulled into the large femoral sheath (Figure 2). As soon as the lead was completely within the sheath, the entire unit (sheath with the inside lead) was removed from the patient's body. On the operating table outside the patient's body, the lead was removed from the

sheath and the large vegetation could be seen still attached to the lead (Figure 3).

Discussion

Complete removal of the device system, including the vegetation, is mandatory for successful treatment of infected CIEDs.^{1,2} The larger the vegetation, the more likely is the

need for open surgical extraction, especially in vegetations larger than 20 mm². However, the majority of infected mass may not reach this cut-off, indicating that a relevant portion of the affected patients will still undergo transvenous lead extraction.⁶ In order to avoid the use of a transvenous aspiration system we employed a large-sized sheath to prevent potential vegetation embolization. The Micra TPS introducer sheath (Medtronic) has been safely used in contemporary implantation of leadless pacemaker⁷ in more than 50,000 patients worldwide so far and is most likely large enough to be able to surround both the lead and the vegetation of this size during lead explantation from the groin, therefore facilitating successful explantation. Indeed, it has been used for this purpose by others but, according to our knowledge, not yet with such a large vegetation.⁸ We herein demonstrate that this approach may offer a very safe option for lead and vegetation extraction. A limitation of this case is the short lead dwell time of only 8 months simplifying the procedure. In different clinical situations with a longer dwell time it could be necessary to use a steerable sheath in addition to facilitate successful snaring of the lead, but using such a usually smaller-diameter tool (compared to the larger Micra TPS introducer sheath) as an outer sheath over the electrode may increase the risk for vegetation embolization. In such a scenario, it can be recommended to still use a steerable sheath (through the Micra TPS introducer sheath) to snare the lead or lead fragment. For the extraction itself, the larger Micra TPS introducer sheath should then be railed and advanced over the steerable sheath

up to the distal end of the electrode as demonstrated by Gabriels and colleagues.⁸

In summary, the use of the Micra TPS introducer sheath as a femoral workstation offers an additional option during lead extraction. Whether this approach is similarly safe for all leads (independently of the lead dwell time) and/or up to which vegetation size will require further work.

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